

previously, is shown in **FIG. 15**. For clarity, corresponding features to those shown in **FIGS. 3 to 5** are denoted with the same reference numerals. The cam drive arrangement includes a cam follower **124** that rides over the surface of the cam **68** as the cam rotates and is arranged to impart drive to a drive member **126**, for example in the form of a tappet, that is coupled to the plunger **66**. The drive member **126** is driven under the influence of the cam arrangement **68, 124** to reciprocate within a cylinder **128** and, thus, imparts reciprocating movement to the plunger **66**. A pin **130** is secured to the drive member **126**, and a return spring **132** is mounted upon a shaft **134** of the engine which co-operates with the pin **130** so as to return the drive member **126** and follower mechanism as the follower **124** rides over a falling flank of the cam **68**. The plunger **66** is arranged to be substantially perpendicular to the axis of the injector.

[0168] As can be seen in **FIG. 15**, the diameter of the common rail **59** is smaller than that of the shaft **134**. It is possible to use a common rail **59** of relatively small size, as it need only be charged with fuel at the first, moderate pressure level due to the provision of the pump arrangement **63** and the rail control valve **62** which permit an increased pressure level to be supplied to the injector **50** when the rail control valve **62** is closed. By way of example, the moderate pressure of fuel within the rail may be around 300 bar, compared with pressures around 2000 bar in known common rail systems. As the common rail **59** may be of relatively small size, it is possible to house the rail **59** within another component of the engine.

[0169] In an alternative configuration to that shown in **FIG. 15**, the shaft **134** may be the engine rocker shaft and may be hollow so that the rail may extend through a region of the hollow shaft. As a further alternative the rail may be provided within a region of an engine cylinder head.

[0170] It will be appreciated that the fuel injection system of any of the embodiments described previously, and not just that in **FIGS. 3 to 5**, may be implemented as in **FIG. 15**.

[0171] Obviously, many modifications and variations of the present invention are possible in light of the above teachings. The invention may be practiced otherwise than as specifically described within the scope of the appended claims.

What is claimed is:

1. A fuel injection system for supplying pressurised fuel to a fuel injector, the fuel injection system comprising:

- a rocker shaft,
- an accumulator volume for supplying fuel at a first injectable pressure level to the fuel injector through a fuel supply passage,
- a pump arrangement for increasing the pressure of fuel supplied to the injector to a second injectable pressure level, and
- a valve arrangement disposed in a fuel supply passage between the pumping chamber and the accumulator volume and operable between a first position in which fuel at the first injectable pressure level is supplied to the injector and the pump chamber is in communication with the accumulator volume such that fuel at the first injectable pressure level may flow from the accumulator volume to the pump chamber, and a second position

in which communication between the injector and the accumulator volume is broken so as to permit fuel at the second injectable pressure to be supplied to the injector,

wherein the accumulator volume is comprised in the rocker shaft.

2. The fuel injection system as claimed in claim 1, wherein the rocker shaft is hollow and the accumulator volume is a rail that extends through the hollow rocker shaft.

3. The fuel injection system as claimed in claim 1, wherein the rocker shaft is hollow to itself define the accumulator volume.

4. The fuel injection system as claimed in claim 1, wherein the pump arrangement and the injector are combined in a common unit.

5. The fuel injection system as claimed in claim 1, wherein the pump arrangement includes a pump chamber defined within a plunger bore, and a plunger which is movable within the plunger bore to cause pressurisation of fuel within the pump chamber when the valve arrangement is in the second position.

6. The fuel injection system as claimed in claim 5, wherein the pump arrangement includes a cam drive arrangement having a cam for imparting drive to the plunger.

7. The fuel injection system as claimed in claim 6, wherein the cam includes a first cam lobe and at least one further cam lobe, whereby the first cam lobe effects pressurisation of fuel within the pump chamber to the second pressure level during at least a part of a first pumping stroke of the plunger, and a further one of the lobes effects pressurisation of fuel within the pump chamber to the first pressure level during a further pumping stroke of the plunger.

8. The fuel injection system as claimed in claim 6, including a plurality of injectors, each having an associated pumping plunger for performing a pumping stroke and a return stroke, and whereby each of said plungers is driven by means of an associated cam that is oriented relative to the or each of the other cams and has a surface shaped such that the associated return stroke is interrupted to define at least one step of plunger movement that is substantially synchronous with the pumping stroke of one of the other plungers.

9. The fuel injection system as claimed in claim 8, wherein each cam surface is shaped to include a rising flank, and wherein the remainder of the cam surface includes a surface irregularity which serves to define an interval of interruption in the return stroke of the associated plunger.

10. The fuel injection system as claimed in claim 8, wherein each cam is driven by means of a shaft, in use, and wherein each cam surface is shaped to define a number of steps of movement through the associated return stroke that is equal to the number of other cams driven by the same shaft.

11. The fuel injection system as claimed in claim 6, wherein the pump arrangement further comprises a drive member which is co-operable with the plunger and wherein the drive member is coupled to a rocker arm which is carried upon the rocker shaft such that movement of the drive member imparts pivotal movement to the rocker arm.

12. The fuel injection system as claimed in claim 1, wherein the valve arrangement includes a three-position valve that is operable between the first and second positions and a further, third position in which the pump arrangement communicates with a low pressure drain, thereby to permit spill-end of injection.